

Amendment to the Drawing

The attached sheet of replacement drawings includes one change to FIG. 2. This sheet, which includes FIGS. 1 and 2, replaces the original sheet including FIGS. 1 and 2. In FIG. 2, the reference numeral designating the polishing pad has been changed from "112" to --111--. This matches the amendments made herein to the Specification.

Attachment: Replacement Sheet showing FIG. 1 and FIG. 2.

REMARKS

Claims 1, 3-5 and 7 are pending in the application. By this paper, claims 1, 5 and 7 have been amended and claims 2 and 6 have been cancelled. Reconsideration and allowance of claims 1, 3-5 and 7 are respectfully requested.

Objection to the Drawings

The drawings stand objected to as failing to comply with 37 CFR § 1.84(p)(4). According to the office action, the reference character "112" has been used to designate both the polishing pad and the carrier drive shaft in FIG. 2.

By this paper, the specification and drawing are amended to correct the noted deficiency. A Replacement Sheet showing FIG. 1 and FIG. 2 is attached hereto. On the Replacement Sheet, the reference numeral designating the polishing pad has been changed from "112" to --111--. This matches the amendments made herein to the Specification. The Specification has been amended at paragraphs {0013} – [0015] and [0028] to change references from "polishing pad 112" to -- polishing pad 111 --.

No new matter is added by this amendment. Withdrawal of the objection to the Drawings is respectfully requested.

Prior Art Rejections

Claims 1, 3-5 and 7 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. patent number 6,146,241 to Lee, et al. ("Lee"). Claims 2 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lee in view of U.S. patent number 6,273,797 to Becker, et al. ("Becker"). Reconsideration of these rejections is respectfully requested. The cited references fail to disclose all the limitations of the claims.

By this paper, claim 1 has been amended by adding limitations of claim 2 and canceling claim 2. Similarly, claim 5 has been amended by adding limitations of claim 6 and canceling claim 6.

The presently disclosed embodiments relate to “a chemical mechanical polishing method and apparatus ... that reduce embedded particles during CMP processing. Throughout the CMP process, the wafer-carrier and the polish platen turn or rotate in the same direction. This enables particles to become embedded in the oxide or other film surface. In the disclosed process, during a final polish step, the wafer carrier or polish platen is turned or rotated in the opposite direction. *Embedded particles are then pulled out of the oxide or film, creating a much cleaner wafer.* Paragraph [0007], *emphasis added*. This is reflected in the claims. For example, claim 1 recites:

reversing the direction of rotation of one of the wafer carrier and the polishing pad during a final polishing operation to remove embedded particles from the polished surface of the semiconductor wafer

Similarly claim 5 recites

a control system ... to reverse rotation of the semiconductor wafer relative to the polishing pad during a second polishing interval to remove embedded particles from the surface of the semiconductor wafer

Still further, amended claim 7 recites

control means ... producing a first relative rotation during a first polishing duration and producing an opposite relative rotation during a second polishing duration to remove embedded particles from the surface of the semiconductor wafer.

The presently-claimed invention thus is a novel enhancement to a CMP process to reduce “surface particle contamination of semiconductor wafers during CMP processes. After a primary polishing operation, a relatively brief reverse polishing process is introduced to remove contaminants including even sticky particles from the surface of the semiconductor wafers. This process can dramatically reduce defectivity and particle damage caused during CMP processes. This substantially reduces manufacturing cost as the manufacturing yield increases” (paragraph [0035]).

In contrast, Lee focuses on the quality of polishing produced by the CMP system:

Also in a preferred embodiment, the polishing pad and the sample are rotated in opposite directions **to more efficiently effect polishing.**

Lee, column 9, lines 33-35. Lee fails to disclose the claimed feature of removing embedded particles from the wafer surface.

Further, as amended, claims 1 and 5 include a feature of spraying the polishing pad with a liquid to remove the particles from the polishing pad. The examiner acknowledges that this feature is absent from Lee. This feature is directly related to the benefit provided by the presently claimed invention: *"the spray nozzle 126 directs a high pressure spray at the polishing pad to dislodge and remove the particles from the pad surface so that the particles are not re-introduced to the surface of the semiconductor wafer 114."* Paragraph [0028] (*emphasis added*). Becker discloses providing a pressurized spray to a CMP polishing pad to remove particles from the pad. However, there is no motivation to combine Becker's spray with Lee's reversible CMP system, since Lee discloses reversing the CMP motor to dislodge slurry particles from the pad (Lee, column 1, lines 59-60).

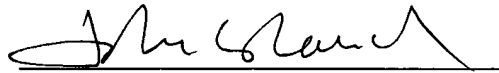
Moreover, neither applied reference discloses the claimed feature noted above, removing particles that may be embedded in the surface of the wafer. The present application notes at paragraph [0004]: "Contaminants such as the abrasive particles from the slurry, air bubbles in the oxide or particles of oxide itself may contaminate the surface of the wafer, becoming embedded in the surface. The result is a localized lack of planarity and non-uniform surface texture." To correct this problem, the claimed invention of claims 1, 5 and 7 provide for reversing the direction of rotation to remove embedded particles from the surface of the wafer, not from the polishing pad. And once the particles are removed from the wafer surface, the invention defined by claims 1 and 5 goes a step farther and provides for spraying liquid on the polishing pad to remove particles from the polishing pad.

The result is an efficient, effective method for improving manufacturing yield by creating a much cleaner wafer. The cited references lack this ability. Accordingly, the present invention defined by independent claims 1, 5 and 7 is submitted to be allowable over the cited references. Withdrawal of the rejection of these claims is respectfully requested. Further, claims 3-4 are dependent from claim 1 and are allowable for the same reasons.

Application no. 10/780,409
Amendment dated: February 14, 2006
Reply to office action dated: November 14, 2005

With this response, the application is believed to be in condition for allowance.
Should the examiner deem a telephone conference to be of assistance in advancing the application to allowance, the examiner is invited to call the undersigned attorney at the telephone number below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "John G. Rauch", written over a horizontal line.

John G. Rauch
Registration No. 37,218
Attorney for Applicant

February 14, 2006
BRINKS HOFER GILSON & LIONE
P.O. BOX 10395
CHICAGO, ILLINOIS 60610
(312) 321-4200